

TITLE OF THE INVENTION

PRINTER AND CONTROL METHOD THEREFOR

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BACKGROUND OF THE INVENTION

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This invention relates to a printer which performs printing based on image information obtained from an information processing apparatus and a control method for the printer and, more particularly to a printer, to which an optional device can be attached, and a control method for the printer.

Recently, a printer, which has a simplified construction and which performs various operations by control of software programs which run on a host computer, has been put into practical use as so-called host-base printer. In this system, various printer operations are controlled via a printer driver in the host computer, by bidirectional communication between the printer and the host computer.

Upon starting print operation, the printer driver installed in the host computer determines whether or not it supports the printer connected to the host computer. In this system, to attach an optional device to the printer, it is necessary that

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the printer driver has ^{the} capability to communicate with the optional device. For example, if an optional device of the printer is a postcard feeder, the capability of the printer driver must include the card feeder function.

Accordingly, in a case where a new optional function not supported by the printer driver is employed, a revised printer driver is included in a package upon shipment. When the new optional function is installed, the previous printer driver is replaced by the revised printer driver.

However, the above conventional technique has the following problem.

Conventionally, the host computer uses one device ID to recognize the printer regardless of option-device setting ^{status} (i.e., attached or not) ~~status~~ of the printer. More specifically, the host computer recognizes a printer having a newly-attached optional device with the same ID as that used to recognize the printer before the optional device is attached to the printer. Accordingly, the host computer cannot detect whether or not the optional device has been attached to the printer. If a printer, to which an optional function is attached, is connected to the host computer but the host computer system is not updated to include the new function, the printer

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might perform erroneous operation. Similarly, when a printer, to which no optional device is attached, is connected to the host computer but the host computer system has been updated to include the new function of the printer driver, the printer might perform erroneous operation.

SUMMARY OF THE INVENTION

10 The present invention has been made in consideration of the above situation, and has its object to solve the above problem, to provide a printing system in which a printer and an information processing apparatus are connected.

15 According to the present invention, the foregoing object is attained by providing a printer which inputs print information from an information processing apparatus connected to the printer and performs print processing based on the print
20 information, comprising: holding means for holding identification information on option-device setting status of the printer, the identification information being readable by the information processing apparatus; change means for changing the
25 identification information held in the holding means in accordance with attachment status of an optional

device for expanding function of the printer; and
identification-information output means for
outputting the identification information held in the
holding means, in correspondence with a request from
5 the information processing apparatus.

Preferably, the above printer further comprises
request causing means for causing the information
processing apparatus to issue an identification-
information request to the printer when the optional
10 device has been attached to the printer.

Preferably, the optional device has memory
means for storing the identification information of
the optional device.

Preferably, the information processing
15 apparatus further comprises driver-change means for
changing a driver for the printer in accordance with
the identification information outputted from the
printer.

Preferably, the optional device has a barcode
20 corresponding to the identification information of
the optional device.

Further, the foregoing object is attained by
providing a printing method for a printer which
inputs print information from an information
25 processing apparatus connected to the printer and
performs print processing based on the print

construction of an ID-ROM controller 31 in Fig. 6;

Fig. 8A is a perspective view showing an option unit of the second embodiment;

Fig. 8B is a schematic view showing a
5 connection between an electrical contact point 153 and an ID ROM 34 in the option unit 33 of Fig. 8A;

Fig. 8c is a perspective view explaining attachment of the option unit to the printer of the second embodiment;

10 Fig. 9 is a flowchart showing the device-ID selection by the printer of the second embodiment; and

Fig. 10 is an example of a memory map of the printer of the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will now be described in detail in accordance with
20 the accompanying drawings.

[First Embodiment]

Fig. 1 shows the construction of a printer according to a first embodiment of the present invention.. In Fig. 1, reference numeral 1 denotes an
25 interface (I/F) circuit which is connected to a host computer 100, an external device, which controls the

printer, for bidirectional communication between the printer and the host computer; 2, an I/F controller for controlling the I/F circuit 1; 3, a RAM; 4, a RAM controller for storage control of the RAM 3; 5, an image-output adjustment circuit for outputting print data from the RAM 3 in correspondence with output timing of a printer engine 6; and 7, an engine I/F circuit for controlling the printer engine 6 under the control of a controller 8.

10 The controller 8 controls the overall printer of the present embodiment. Numeral 9 denotes an ID ROM holding device IDs of the printer, to be described later; 10, an ID-ROM controller for selecting a device ID to be outputted from the ID ROM 9 into the controller 8, as described later; and 11, an attachment unit for attaching an option unit 15 to the printer. The option unit 15 includes various devices attachable to the printer such as an automatic document feeder (ADF), a sorter, a double-sided printing unit, a paper cassette, a finisher, and a scanner.

 The I/F controller 2 is connected to the I/F circuit 1 with a control signal via a control signal line. Also, the I/F circuit 1 is connected to the RAM 3. When image information is received from the host computer 100, the I/F controller 2 controls the

I/F circuit 1 to output the image information to the RAM 3.

The image information received from the host computer is temporarily stored in the RAM 3. The RAM
5 controller 4, connected to the RAM 3, controls the read/write operation with respect to the RAM 3. The image information stored in the RAM 3 is transferred to the image-output adjustment circuit 5, and
10 outputted to the printer engine 6, in synchronization with output timing of the printer engine 6.

The printer engine 6 prints an image on a print medium based on the input image information. The printer engine 6 is connected to the engine I/F
15 circuit 7. The engine I/F circuit 7 sends a control command to the printer engine 6, or receives from the printer engine 6 a status signal indicating operation status of the printer engine 6.

The I/F controller 2, the RAM controller 4, the image-output adjustment circuit 5 and the engine I/F
20 circuit 7 are connected to the controller 8. The controller 8 is connected to the ID ROM 9 in which a plurality of device IDs of the printer are stored. The ID-ROM controller 10 selects one of the device ID's in the ID ROM 9, and outputs the selected device
25 ID into the controller 8. When the host computer 100 makes a device-ID request to the printer via the I/F

circuit 1, the selected device ID is read from the controller 8 and outputted to the host computer 100.

After the power of the printer has been turned on, the ID-ROM controller 10 detects whether or not the option unit 15 is attached to the attachment unit 11, at predetermined periods. When the ID-ROM controller 10 detects that the option unit 15 is attached to the attachment unit 11, the ID-ROM controller 10 can discriminate the type of the option unit 15. The ID-ROM controller 10 selects a device ID to be outputted to the controller 8 from the device IDs stored in the ID ROM 9, in accordance with the type of the option unit 15.

Fig. 2 shows the general construction of the ID ROM 9 of the present embodiment. In this embodiment, the ID ROM 9 contains three device IDs. Note that in the following description, the three device IDs are stored in the ID ROM 9, however, the present invention is not limited to this number of device IDs. The number of device IDs can be changed in accordance with the number of optional devices which may be connected to the printer.

In Fig. 2, numeral 21 denotes a memory in which a device ID corresponding to a device A is stored; 22, a memory in which a device ID corresponding to a device B is stored; 23, a memory in which a device ID

corresponding to a device C is stored; and 24, a selector for selecting one of the memories 21 to 23. The memories 21 to 23 are connected to the selector 24. The selector 24 selects one of outputs from the memories 21 to 23, in accordance with a selection signal from a selection-signal input terminal 25, and outputs the selected memory content through a selection output terminal 26. Note that the device IDs stored in the memories 21 to 23 are information on the model of the printer and optional devices connected to the printer. Further, a device ID only indicative of the model of the printer is also stored in the ID ROM 9.

In the present embodiment, when the option unit 15 is attached to the attachment unit 11 of the printer, the ID-ROM controller 10 detects the connection between the option unit 15 and the attachment unit 11. Then the ID-ROM controller 10 outputs a selection signal into the ID ROM 9 to read the device ID of the printer, in accordance with the type of the option unit 15. The ID ROM 9 is controlled by the selector based on the selection signal, to output a new device ID by the selection-output terminal 26 to the controller 8.

25 The host computer 100 reads the device ID from
the controller 8 by processing as shown in Fig. 4 to

be described later.

Next, detection of the option unit 15 attached to the printer, according to the first embodiment, will be described with reference to Figs. 3A and 3B.

5 Fig. 3A is a perspective view showing the option unit 15. Fig. 3B is a perspective view explaining attachment of the option unit 15 to the printer.

As shown in Fig. 3A, the option unit 15 is
10 provided in advance with a barcode label 151 indicative of the device ID of the option unit 15. As shown in Fig. 3B, a printer 50 of the present embodiment has a barcode reader 152 at the attachment unit 11. Fig. 4 shows device-ID selection in
15 accordance with the device ID of the option unit 15 having the above construction, performed by the printer 50 having the above construction.

Fig. 4 is a flowchart showing device-ID selection by the printer of the first embodiment.

20 When the power of the printer 50 is turned on and the process starts, the ID-ROM controller 10 detects whether or not the option unit 15 has been attached to the attachment unit 11 (step S11). If it is YES, i.e., it is detected at step S11 that the
25 option unit 15 has been attached to the printer 50 via the attachment unit 11, the ID-ROM controller 10

reads the barcode label 151 by using the barcode
reader 152, and interprets the obtained barcode (step
S12). The ID-ROM controller 10 outputs a selection
signal to the ID ROM 9 in accordance with barcode
5 data obtained by interpretation of the read barcode
(step S13), the ID ROM 9 outputs a device ID
corresponding to the selection signal to the
controller 8 (step S14). On the other hand, if it is
detected at step S11 that the option unit 15 has not
10 been attached to the attachment unit 11 when or after
the power of the printer has been turned on, the
reading of barcode is attempted a predetermined
number of times. In this case, as no barcode is read,
it is determined that the option unit 15 has not been
15 attached to the attachment unit 11, and a device ID
only indicative of the model of the printer 50 is
selected from the ID ROM 9 (step S15). The above
processing is repeated at predetermined intervals.

When the host computer 100 makes a device-ID
20 request regarding the optional-device setting status
of the printer 50, the controller 8 transmits the
device ID outputted from the ID ROM 9 to the host
computer 100.

Note that in the ID ROM 9, selection by the
25 selector 24 may be performed by an operator, from a
control panel (not shown) of the printer.

initialization on the printer, where the device ID of the printer is read, so that the host computer 100 receives the device ID indicating the model of the printer and the type of the newly-attached optional
5 device.

Next, printer control on the host computer side in a case where the option-device setting status of the printer is changed will be described with reference to the flowchart of Fig. 5. Fig. 5 shows
10 an algorithm for printer-driver selection by the host computer 100 based on the device ID of the printer. The host computer 100 of the present embodiment executes this processing when the power of the host computer is turned on or when the system is reset.
15 Note that the processing may be performed as an interrupt processing when the host computer 100 issues a device-ID request to the printer.

When the power of the host computer 100 is turned on or the system is reset, resetting is
20 performed at step S101. Next, at step S102, the device ID of the printer is read from the printer, and the option-device setting status of the printer is examined. At step S103, it is determined whether or not the printer driver, which is currently in the
25 host computer 100, supports the currently-connected printer, based on the device ID read at step S102.

data is transferred to the printer for print-output.
Then the process returns to step S105.

On the other hand, if it is determined at step
S109 that the overall system is not in print-possible
5 status (including status where an appropriate printer
driver is not operative), the process proceeds to
step S111, at which the host computer 100 displays an
warning message to inform an operator that printing
is impossible. Then the process returns to step S105.

10 Further, at step S103, if it is determined as a
result of examination of the read device ID that the
printer corresponding to the device ID is not
supported by the printer driver currently operative
in the host computer 100, the process proceeds to
15 step S104, at which it is determined whether or not a
printer driver corresponding to the device ID, which
the host computer 100 can read and activate, exists
in an external storage device such as a hard disk, or
already exists in the memory of the host computer 100.
20 If it is determined that the printer driver exists,
the process proceeds to step S106, at which the
printer driver is read into the memory, for example,
in accordance with necessity, and the printer driver
is made active in the memory. Then the process
25 proceeds to step S105.

On the other hand, if it is determined that the

printer driver corresponding to the printer does not exist, the process proceeds to step S107, at which an warning message is displayed to inform the operator that printing is impossible, similar to step S111..

5 Then the process proceeds to step S105.

Note that on the host computer side, acquisition of device ID is performed when the power of the host computer 100 is turned on, or when the system is reset, or when the status of the printer is changed, or by polling the printer at predetermined periods.

As described above, according to the present embodiment, when an optional device is attached to the printer, the printer changes its device ID, and changes the output from the I/F to the host computer. The host computer detects the change of the output from the I/F circuit, and makes a device-ID request to the printer. Then the host computer reads the new device ID, selects a printer driver corresponding to the optional device of the printer, based on the read device ID, and performs printing. When the printer driver is inappropriate for the printer, the above processing prevents printing by using the inappropriate printer driver, thus avoiding undesired print result. Further, this effectively prevents various inconveniences caused in printing with an

inappropriate printer driver.

In the present embodiment, especially when plural types of optional devices are attached to the printer, device IDs corresponding to attachment
5 statuses of the respective optional devices can be prepared in advance, and an appropriate device ID can be outputted to the host computer.

[Second Embodiment]

10 In the first embodiment, device IDs corresponding to all the optional devices which are attachable to the printer are stored in the ID ROM 9 of the printer, and a device ID corresponding to the optional-device setting status of the printer is
15 selected and supplied to the controller 8. However, the present invention is not limited to this arrangement. For example, it may be arranged such that device IDs corresponding to attachment statuses of the optional devices are respectively stored in
20 the optional devices, and when the optional device is attached to the printer, the device ID is read from the optional device. This construction will be described as a second embodiment with reference to Figs. 6 to 9.

25 Fig. 6 shows the construction of the printer according to the second embodiment of the present

invention. Fig. 7 shows the detailed construction of an ID-ROM controller 31 in Fig. 6.

In Figs. 6 and 7, the elements corresponding to those in Figs. 1 and 2 have the same reference numerals, and the explanation of those elements will be omitted. In the second embodiment, the ID-ROM controller 31 reads a device ID indicative of the model of the printer, from an ID ROM 32 in the printer, or reads a device ID indicative of an option unit 33, from an ID ROM 34 in the option unit 33 when attached to the printer. When the option unit 33 is attached to the printer, the ID-ROM controller 31 outputs the content of the ID ROM 34 to the controller 8. When the option unit 33 is not attached to the printer, the ID-ROM controller 31 outputs the content of the ID ROM 32 to the controller 8.

In Fig. 7, numeral 301 denotes an ID output unit; 302, a selector for switching outputs from the ID ROM 32 in the printer and the ID ROM 34 in the option unit 33; 303, an input terminal A for inputting the output from the ID ROM 32 to the selector 302; 304, an input terminal B for inputting the output from the ID ROM 34 to the selector 302; and 305, an option detection unit for detecting that the option unit 33 is attached to the printer. The

output from the option detection unit 305 is inputted into an input terminal of the selector 302. When the option unit 33 is connected to the printer, the input B, i.e., the output from the ID ROM 34 in the option unit 33 is selected.

In the second embodiment, the option unit 33 includes various optional devices each having the ID ROM 34 in which a device ID of the device is stored.

Next, the detection of the option unit 33 by the ID-ROM controller 31 will be described.

Fig. 8A is a perspective view showing the option unit 33. Fig. 8B is a schematic view showing connection between an electrical contact point 153 and the ID ROM 34 in the option unit 33. Fig. 8c is a perspective view for explaining the attachment of the option unit 33 to the printer of the second embodiment.

As shown in Figs. 8A to 8C, the option unit 33 has an electrical contact point 153. The electrical contact point 153 has a power-supply terminal 153A for receiving electric power from a printer 51 of the second embodiment, an output terminal 153B for outputting the content of the ID ROM 34 in the option unit 33, a control terminal 153C for controlling the ID ROM 34 from the ID ROM controller 31 in the printer 51, and a GND (ground) terminal 153D. As

it is determined that the option unit 33 is not attached to the printer 51. Then the device ID of the printer 51 itself is read from the ID ROM 32 and transferred to the controller 8. The above
 5 processing is repeated at predetermined periods.

On the printer side, device-ID selection, to be described later, is performed when the power of the printer is turned on, or when polling at a predetermined intervals by the host computer is
 10 performed, or the status of the printer is changed (including a case where an optional device has been attached/detached to/from the printer). When a device-ID request has been made by the host computer, a response is made immediately. It may also be
 15 arranged such that a device ID is obtained (recognized) and a response is made with the device ID after the device-ID request has been received.

As described above, according to the second embodiment, since a device ID can be freely set by
 20 each option unit, more option units, in comparison with the first embodiment, can be used in printing without any change of settings in the printer.

Especially, even when an option unit, which was not taken into consideration upon designing the
 25 printer, is connected to the printer, if the option unit has an ID ROM and if an appropriate printer

driver is installed into the host computer in advance, the appropriate printer can be selected by reading a device ID from the ID ROM. This enables printing corresponding a variety of option units.

5 Note that the device-ID reading and printer-driver selection on the host computer side are the same as those in the first embodiment, therefore the explanation of these processings will be omitted. In this case, the host computer 100 must have printer
10 drivers corresponding to the device IDs stored in the ID ROM 32 in the printer and stored in the ID ROM 33 in the option units.

See Fig. 2
15 As described above, according to the embodiments, the device ID of the printer is changed on the printer side, in correspondence with an optional device attached to the printer, and the device ID is discriminated on the host computer side. Thus, a printer driver corresponding to the optional device attached to the printer can be appropriately
20 supported for printing. Further, if a currently operative printer driver is inappropriate, printing is not performed, and an warning message is displayed to inform an operator that printing is impossible. This prevents printing using an inappropriate printer
25 driver, thus avoiding printing error, and further, prevents various inconveniences occur in the host

computer and the printer, caused by printing with inappropriate printer driver.

The present invention can be applied to a system constituted by a plurality of devices (e.g.,
5 host computer, interface, reader, printer) or to an apparatus comprising a single device (e.g., copy machine, facsimile).

Further, the object of the present invention can be also achieved by providing a storage medium
10 storing program codes for performing the aforesaid processes to a system or an apparatus, reading the program codes with a computer (e.g., CPU, MPU) of the system or apparatus from the storage medium, then executing the program.

15 In this case, the program codes read from the storage medium realize the functions according to the embodiments, and the storage medium storing the program codes constitutes the invention.

Further, the storage medium, such as a floppy
20 disk, a hard disk, an optical disk, a magneto-optical disk, CD-ROM, CD-R, a magnetic tape, a non-volatile type memory card, and ROM can be used for providing the program codes.

Furthermore, besides aforesaid functions
25 according to the above embodiments are realized by executing the program codes which are read by a

computer, the present invention includes a case where
an OS (operating system) or the like working on the
computer performs a part or entire processes in
accordance with designations of the program codes and
5 realizes functions according to the above embodiments.

Furthermore, the present invention also
includes a case where, after the program codes read
from the storage medium are written in a function
expansion card which is inserted into the computer or
10 in a memory provided in a function expansion unit
which is connected to the computer, CPU or the like
contained in the function expansion card or unit
performs a part or entire process in accordance with
designations of the program codes and realizes
15 functions of the above embodiments.

In a case where the present invention is
applied to the aforesaid storage medium, the storage
medium stores program codes corresponding to the
flowcharts described in the embodiments. Briefly,
20 the storage medium stores each module shown as an
example of a memory map in Fig. 10. More
specifically, program codes which correspond to
holding module (holding a device ID which the host
computer can discriminate), changing module (changing
25 the device ID when the power of the printer is turned
on, or it is detected by polling with a predetermined

by changing the printer driver in the information
processing apparatus in accordance with the
identification information obtained from the optional
device. This enables to connect various option units
5 to the printer.

Further, in the information processing
apparatus, it is determined whether or not a
currently control program for controlling the printer
is appropriate, in accordance with the identification
10 information from the printer. If the control program
is inappropriate, an appropriate control program is
selected based on the identification information and
printing can be performed. Further, even if the
information processing apparatus does not have an
15 appropriate control program, printing by using an
inappropriate control program can be prevented, thus
avoiding undesired print result.

As many apparently widely different embodiments
of the present invention can be made without
20 departing from the spirit and scope thereof, it is to
be understood that the invention is not limited to
the specific embodiments thereof except as defined in
the appended claims.